Amendments to the Claims

Claims 1-252 (cancelled).

Claim 253 (currently amended): CMOS transmitter carrier circuitry configured to receive a digital clock signal, the circuitry comprising:

a phase locked loop including a voltage controlled oscillator configured to multiply the frequency of the digital clock signal by a predetermined multiple and control circuitry to maintain a desired frequency, the phase locked loop having an output providing a transmitter carrier, the control circuitry including a first charge pump coupled to a start-up circuit and configured to pump a frequency of the voltage controlled oscillator in response to a start-up command from the start-up circuit, and a second charge pump and configured to selectively pump up or down the frequency of the voltage controlled oscillator in steps smaller than the steps of the first charge pump; and

divider circuitry having an input coupled to the voltage controlled oscillator and receiving the multiplied frequency, the divider circuitry being configured to divide by the predetermined multiple, and the divider circuitry having an output coupled to the control circuitry.

Claim 254 (currently amended): CMOS transmitter carrier circuitry in accordance with claim 253, wherein[:] the phase locked loop includes a loop filter coupled to the voltage controlled oscillator, wherein ~~and~~ the control circuitry comprises[:] a phase-frequency detector coupled to the divider circuitry output, ~~; and~~ wherein ~~a charge pump,~~ the phase-frequency detector and the first and second charge pumps are ~~pump being~~ coupled to the voltage controlled oscillator and to the loop filter, and wherein the loop filter is a passive loop filter.

Claim 255 (previously presented): CMOS transmitter carrier circuitry in accordance with claim 253, wherein the voltage controlled oscillator has a plurality of outputs that are configured to be angularly spaced apart with respect to phase.

Claim 256 (previously presented): CMOS transmitter carrier circuitry in accordance with claim 255, further comprising a frequency doubler that receives at least some of the angularly spaced apart outputs of the voltage controlled oscillator, and that is configured to produce a signal with a frequency that is double the frequency of the outputs of the voltage controlled oscillator.

Claim 257 (previously presented): CMOS transmitter carrier circuitry in accordance with claim 256, wherein the frequency doubler comprises first and second Gilbert cells coupled together, a frequency generator configured to apply a first sinusoidal wave to the first Gilbert cell, and a phase shifter coupled between the first and second Gilbert cells to apply to the second Gilbert cell a sinusoidal wave that is shifted from the first sinusoidal wave.

Claim 258 (currently amended): CMOS transmitter carrier circuitry in accordance with claim 254, wherein the charge pump comprises:

a first charge pump coupled to a start-up circuit and configured to pump a frequency of the voltage controlled oscillator up in coarse, medium or medium fine steps in response to a start-up command from the start-up circuit; and

a second charge pump coupled to the control circuitry and configured to pump up or down the frequency of the voltage controlled oscillator in fine steps in response to signals from the control circuitry.

Claim 259 (previously presented): CMOS transmitter carrier circuitry in accordance with claim 258, wherein the start-up circuit is configured to initially invoke coarse or medium steps to pump up the frequency of the voltage controlled oscillator and is configured to invoke medium fine or fine steps when the start-up circuit determines that the frequency of the voltage controlled oscillator is within a few percent of a desired frequency.

Claims 260-284 (cancelled).

Claim 285 (new): A method of manufacturing CMOS transmitter carrier circuitry, the circuitry receiving a digital clock signal, the method comprising:

including in a phase locked loop a voltage controlled oscillator configured to multiply the frequency of the digital clock signal by a predetermined multiple, coupling a loop filter to the voltage controlled oscillator, and coupling a phase-frequency detector and charge pump to the voltage controlled oscillator and to the loop filter to maintain a desired frequency, the phase locked loop having an output providing a transmitter carrier; and

coupling an input of divider circuitry to the voltage controlled oscillator to receive the multiplied frequency, configuring the divider circuitry to divide by the predetermined multiple, and coupling an output of the divider circuitry to the phase-frequency detector.

Claim 286 (new): A method of manufacturing CMOS transmitter carrier circuitry in accordance with claim 285, wherein the loop filter is a passive loop filter.

Claim 287 (new): A method of manufacturing CMOS transmitter carrier circuitry in accordance with claim 285, wherein the voltage controlled oscillator has a plurality of outputs that are configured to be angularly spaced apart with respect to phase.

Claim 288 (new): A method of manufacturing CMOS transmitter carrier circuitry in accordance with claim 287, and further comprising arranging a frequency doubler to receive at least some of the angularly spaced apart outputs of the voltage controlled oscillator, and to produce a signal with a frequency that is double the frequency of the outputs of the voltage controlled oscillator.

Claim 289 (new): A method of manufacturing CMOS transmitter carrier circuitry in accordance with claim 288, wherein the frequency doubler comprises first and second Gilbert cells coupled together, a frequency generator configured to apply a first sinusoidal wave to the first Gilbert cell, and a phase shifter coupled between the first and second Gilbert cells to apply to the second Gilbert cell a sinusoidal wave that is shifted from the first sinusoidal wave.

Claim 290 (new): A method of manufacturing CMOS transmitter carrier circuitry in accordance with claim 285, wherein the charge pump comprises:

a first charge pump coupled to a start-up circuit and configured to pump a frequency of the voltage controlled oscillator up in coarse, medium or medium fine steps in response to a start-up command from the start-up circuit; and

a second charge pump coupled to the phase-frequency detector and configured to pump up or down the frequency of the voltage controlled oscillator in fine steps in response to signals from the phase-frequency detector.

Claim 291 (new): A method of manufacturing CMOS transmitter carrier circuitry in accordance with claim 290, wherein the start-up circuit is configured to initially invoke coarse or medium steps to pump up the frequency of the voltage controlled oscillator and is configured to invoke medium fine or fine steps when the start-up circuit determines that the frequency of the voltage controlled oscillator is within a few percent of a desired frequency.

Claim 292 (new): A method of manufacturing a CMOS transmitter configured to receive a digital clock signal, the method comprising:

including in a phase locked loop a voltage controlled oscillator configured to multiply the frequency of the digital clock signal by a predetermined multiple, coupling a phase-frequency detector and charge pump to the voltage controlled oscillator and to a passive loop filter, to maintain a desired frequency, the voltage controlled oscillator having a plurality of outputs that are angularly spaced apart with respect to phase, the phase locked loop having an output providing a transmitter carrier;

coupling an input of the divider circuitry to one of the outputs of the voltage controlled oscillator, the divider circuitry being configured to divide by the predetermined multiple and having an output coupled to the phase-frequency detector; and

coupling a modulator to the phase locked loop to use the transmitter carrier.

Claim 293 (new): A CMOS transmitter in accordance with claim 292, wherein the voltage controlled oscillator has outputs that are spaced apart, with respect to phase in 45 degree intervals.

Claim 294 (new): A CMOS transmitter in accordance with claim 293, wherein the predetermined multiple is sixteen.

Claim 295 (new): A CMOS transmitter in accordance with claim 292, wherein the charge pump comprises:

a first charge pump coupled to a start-up circuit and configured to pump a frequency of the voltage controlled oscillator up in coarse, medium or medium fine steps in response to a start-up command from the start-up circuit; and

a second charge pump coupled to the phase-frequency detector and configured to pump up or down the frequency of the voltage controlled oscillator in fine steps in response to signals from the phase-frequency detector.

Claim 296 (new): A method of manufacturing a CMOS transmitter in accordance with claim 295, wherein the start-up circuit is configured to initially invoke coarse or medium steps to pump up the frequency of the voltage controlled oscillator and is configured to invoke medium fine or fine steps when the start-up circuit determines that the frequency of the voltage controlled oscillator is within a few percent of a desired frequency.

Claim 297 (new): A method of providing a carrier for wireless communications using an integrated circuit including carrier circuitry, the method comprising:

receiving a digital clock signal with the carrier circuitry, the carrier circuitry being defined by CMOS circuit elements, the carrier circuitry including a phase locked loop having a voltage controlled oscillator, having a loop filter, having a phase-frequency detector, and having a charge pump coupled to the phase-frequency detector and to the loop filter, the voltage controlled oscillator having an output, and the phase locked loop having an output providing a transmitter carrier;

multiplying the frequency of the digital clock signal by a predetermined multiple using the voltage controlled oscillator;

receiving the digital clock signal with the phase-frequency detector and comparing the frequency and phase of the digital clock signal with a second signal and issuing pump up or pump down signals in response to the comparison,

maintaining a desired frequency in response to the pump up and pump down signals using the charge pump, the charge pump receiving the pump up and pump down signals and producing an output having a voltage that varies in response to the pump up and pump down signals; and

dividing by the predetermined multiple using divider circuitry having an input coupled to the output of the voltage controlled oscillator, the divider circuitry having an output defining a second signal coupled to the phase-frequency detector.

Claim 298 (new): A method of providing a carrier for wireless communications in accordance with claim 297, wherein the frequency of the output of the voltage controlled oscillator is configured to vary depending on a voltage provided by the loop filter to the voltage controlled oscillator.

Claim 299 (new): A method of providing a carrier for wireless communications in accordance with claim 298, and comprising filtering the output of the charge pump using the loop filter.

Claim 300 (new): A method of providing a carrier for wireless communications in accordance with claim 297 wherein the predetermined multiple is sixteen.

Claim 301 (new): A method of providing a carrier for wireless communications in accordance with claim 297, further comprising:

pumping up a frequency of the voltage controlled oscillator up in coarse, medium or medium fine steps in response to a start-up command from a start-up circuit, using a first charge pump coupled to the start-up circuit; and

pumping up or down the frequency of the voltage controlled oscillator in fine steps, using a second charge pump coupled to the phase-frequency detector, in response to signals from the phase-frequency detector.

Claim 302 (new): A method of providing a carrier for wireless communications in accordance with claim 301, wherein the start-up circuit is configured to initially invoke coarse or medium steps to pump up the frequency of the voltage controlled oscillator and is configured to invoke medium fine or fine steps when the start-up circuit determines that the frequency of the voltage controlled oscillator is within a few percent of a desired frequency.

Claim 303 (new): A method of providing a carrier for wireless communications, the method comprising:

receiving a digital clock signal using carrier circuitry, the carrier circuitry being defined by CMOS circuit elements;

multiplying the frequency of the digital clock signal by a predetermined multiple using a phase locked loop including a voltage controlled oscillator, a passive loop filter, a phase-frequency detector, and a charge pump coupled to the phase-frequency detector, to the voltage controlled oscillator, and to the loop filter to maintain a desired frequency in response to the pump up and pump down signals, the voltage controlled oscillator having a plurality of outputs that are angularly spaced apart with respect to phase, the phase locked loop having an output providing a transmitter carrier;

receiving the digital clock signal with the phase-frequency detector and comparing the frequency and phase of the digital clock signal with a second signal and issuing pump up or pump down signals in response to the comparison and

dividing by the predetermined multiple using divider circuitry having an input coupled to one of the outputs of the voltage controlled oscillator and having an output defining the second signal coupled to the phase-frequency detector.

Claim 304 (new): A method of providing a carrier for wireless communications in accordance with claim 303 wherein the predetermined multiple is sixteen.

Claim 305 (new): A method of providing a carrier for wireless communications in accordance with claim 304 and further comprising receiving, using a frequency doubler, at least some of the angularly spaced apart outputs of the voltage controlled oscillator, and producing, using the frequency doubler, a signal with a frequency that is double the frequency of the outputs of the voltage controlled oscillator.

Claim 306 (new): A method of providing a carrier for wireless communications in accordance with claim 305 and further comprising producing a signal, using a second frequency doubler coupled to the first mentioned frequency doubler, with a frequency that is double the frequency of the signal produced by the first frequency doubler.

Claim 307 (new): A method of providing a carrier for wireless communications in accordance with claim 305 and further comprising receiving at least some of the angularly spaced apart outputs of the voltage controlled oscillator with a first frequency doubler stage including a first frequency doubler that is configured to produce a signal with a frequency that is double the frequency of the outputs of the voltage controlled oscillator, and receiving other of the angularly spaced apart outputs of the voltage controlled oscillator with a second frequency doubler, of the first frequency doubler state, that is configured to produce a signal with a frequency that is double the frequency of the outputs of the voltage controlled oscillator.

Claim 308 (new): A method of providing a carrier for wireless communications in accordance with claim 307 and further comprising producing a signal with a frequency that is double the frequency of the signals produced by the first frequency doubler stage using a second frequency doubler stage coupled to the first frequency doubler stage.

Claim 309 (new): A method of providing a carrier for wireless communications in accordance with claim 304, wherein the charge pump includes a first charge pump coupled to a start-up circuit and a second charge pump coupled to the phase-frequency detector, the method further comprising:

pumping up a frequency of the voltage controlled oscillator up in coarse, medium or medium fine steps, in response to a start-up command from the start-up circuit, using the first charge pump; and

pumping up or down the frequency of the voltage controlled oscillator in fine steps, in response to signals from the phase-frequency detector, using a the second charge pump.

Claim 310 (new): A method of providing a carrier for wireless communications in accordance with claim 309, wherein the start-up circuit is configured to initially invoke coarse or medium steps to pump up the frequency of the voltage controlled oscillator and is configured to invoke medium fine or fine steps when the start-up circuit determines that the frequency of the voltage controlled oscillator is within a few percent of a desired frequency.

Claim 311 (new): A method of manufacturing an integrated circuit including a transmitter for wireless communications, the transmitter configured to receive a digital clock signal, the transmitter being defined by CMOS circuit elements, the method comprising:

including in a phase locked loop a voltage controlled oscillator to multiply the frequency of the digital clock signal by a predetermined multiple, a passive loop filter, a phase-frequency detector to receive the digital clock signal and compare the frequency and phase of the digital clock signal with a second signal and to issue pump up or pump down signals in response to the comparison, and coupling a charge pump to the phase-frequency detector, the voltage controlled oscillator and to the loop filter to maintain a desired frequency in response to the pump up and pump down signals, the voltage controlled oscillator having a plurality of outputs that are angularly spaced apart with respect to phase, the phase locked loop having an output providing a transmitter carrier;

coupling the input of divider circuitry to one of the outputs of the voltage controlled oscillator, the divider circuitry dividing by the predetermined multiple and having an output defining the second signal coupled to the phase-frequency detector; and

coupling a modulator to the voltage controlled oscillator.

Claim 312 (new): A method of manufacturing an integrated circuit in accordance with 311 wherein the voltage controlled oscillator includes a plurality of stages, one of the stages including a first transistor having a control electrode defining a first input, and first and second power electrodes, wherein the first power electrode defines a first node, wherein the stage further includes a second transistor having a control electrode defining a second input, and having first and second power electrodes, wherein the first power electrode of the second transistor defines a second node, wherein the stage further includes a current source connected to the second power electrodes of the first and second transistors, the current source being configured to direct current away from the second power electrodes of the first and second transistors, and wherein the stage further includes a variable resistance configured to couple the first and second nodes to a supply voltage.

Claim 313 (new): A method of manufacturing an integrated circuit in accordance with claim 311 and comprising:

coupling the first charge pump to a start-up circuit to pump up a frequency of the voltage controlled oscillator in coarse, medium or medium fine steps in response to a start-up command from the start-up circuit; and

coupling a second charge pump to the phase-frequency detector to pump up or down the frequency of the voltage controlled oscillator in fine steps in response to signals from the phase-frequency detector.

Claim 314 (new): A method of manufacturing an integrated circuit in accordance with claim 313, wherein the start-up circuit is configured to initially invoke coarse or medium steps to pump up the frequency of the voltage controlled oscillator and is configured to invoke medium fine or fine steps when the start-up circuit determines that the frequency of the voltage controlled oscillator is within a few percent of a desired frequency.